Maximizing Launch Vehicle and Payload Design Via Early Communications

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The United States' current fleet of launch vehicles is largely derived from decades-old designs originally made for payloads that no longer exist. They were built primarily for national security or human exploration missions. Today that fleet can be divided roughly into small-, medium-, and large-payload classes based on mass and volume capability. But no vehicle in the U.S. fleet is designed to accommodate modern payloads. It is usually the payloads that must accommodate the capabilities of the launch vehicles. This is perhaps most true of science payloads. It was this paradigm that the organizers of two weekend workshops in 2008 at NASA's Ames Research Center sought to alter. The workshops brought together designers of NASA's Ares V cargo launch vehicle (CLV) with scientists and payload designers in the astronomy and planetary sciences communities. Ares V was still in a pre-concept development phase as part of NASA's Constellation Program for exploration beyond low Earth orbit (LEO). The space science community was early in a Decadal Survey that would determine future priorities for research areas, observations, and notional missions to make those observations. The primary purpose of the meetings in April and August of 2008, including the novel format, was to bring vehicle designers together with space scientists to discuss the feasibility of using a heavy lift capability to launch large observatories and explore the Solar System. A key question put to the science community was whether this heavy lift capability enabled or enhanced breakthrough science. The meetings also raised the question of whether some trade-off between mass/volume and technical complexity existed that could reduce technical and programmatic risk. By engaging the scientific community early in the vehicle design process, vehicle engineers sought to better understand potential limitations and requirements that could be added to the Ares V from the mission planning community. From the vehicle standpoint, while the human exploration mission could not be compromised to accommodate other payloads, the design might otherwise be tailored to not exclude other payload requirements. This paper summarizes the findings of the workshops and discusses the benefits of bringing together the vehicle design and science communities early in their concept phases.